

## Risk Assessment Basics

EPA and DEQ rules are risk-based. Everybody should be thinking about risk.

**Risk** is the probability of harm.

It is important to distinguish between:

**Risk assessment** (evaluating what the risk is) and

**Risk management** (deciding how best to deal with the risk).

Elements of risk assessment:

- Hazard identification
- Exposure assessment
- Toxicity assessment
- Risk Characterization

The **exposure assessment** evaluates how much of the chemical you are exposed to (the dose). There are three important elements to an exposure assessment.

Source → Pathway → Receptor (people)

Many different pathways were evaluated in Portland Harbor.

The **toxicity assessment** evaluates how inherently bad (toxic) the chemical is. A basic principle of toxicology is that all chemicals are toxic. The dose determines whether a chemical is poisonous or not.

Non-cancer and cancer effects are evaluated differently.

A **non-cancer** evaluation uses a dose threshold (reference dose, RfD), above which the risk (hazard) may be unacceptable, below which the risk is acceptable.

Hazard quotient = Actual dose / Acceptable dose

Any hazard quotient less than 1 is acceptable.

A **cancer** evaluation assumes there is no safe threshold. Risk is calculated as the probability of getting cancer.

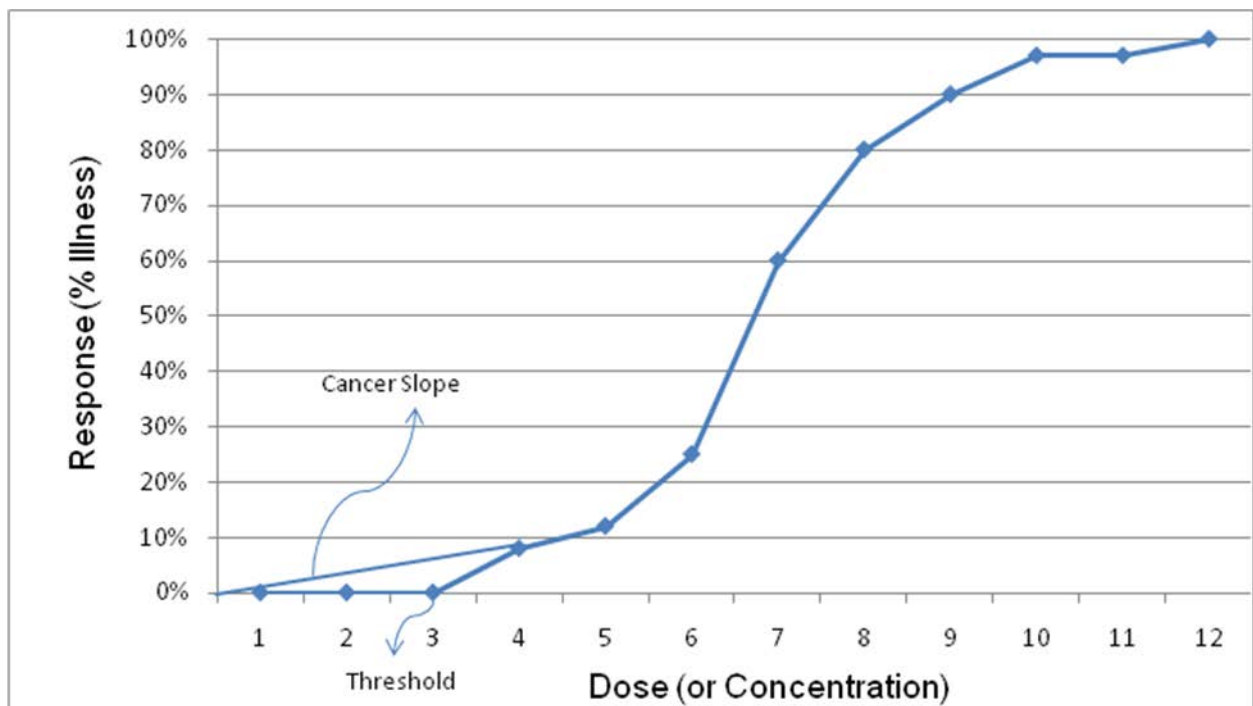
EPA's acceptable excess lifetime cancer risk range is one-in-one-million to one-in-ten-thousand.

Oregon DEQ's acceptable risk is one-in-one-million for individual carcinogens.

### Risk characterization

Risk = Exposure \* Toxicity = (Concentration x Intake) \* Toxicity

**Figure 1. Toxicity Dose/Response Curve**



Risk assessments can be very complicated, but the basic elements are simple. Risk is the combination of exposure and toxicity. All the rest are details.

We focused on human health. Ecological risk assessment is more difficult, but follows the same basic principles.

An evaluation of the effects of **multiple chemicals** is required by EPA and DEQ.

An evaluation of **uncertainty** is required by EPA and DEQ.

### **Preliminary Remediation Goals** (Cleanup Goals)

$$\text{Acceptable Concentration} = \text{Acceptable Risk} / (\text{Intake} * \text{Toxicity})$$

Risk is an important element, but there are also other elements (e.g., cost, implementability) used to select a remedy for a site.